

Claims

1. Method for the production of  $\text{Al}_2\text{O}_3/\text{SiC}$  nanocomposite abrasive grains,

*characterized by the fact* that an aluminum-oxide containing sol is mixed with SiC nanoparticles and subsequently gelled, dried, calcined and sintered.

2. Method according to Claim 1,

*characterized by the fact* that the aluminum-oxide containing sol contains as a solid component superfinely dispersed aluminum oxide monohydrate of the Boehmite type, aluminum alkoxides, aluminum halogenides and/or aluminum nitrate.

3. Method according to either Claim 1 or Claim 2,

*characterized by the fact that* the addition of the SiC nanoparticles is done in an amount of between 0.1 and < 5 mol %, preferably in the range of 0.3 and 2.5 mol % relative to the aluminum contents of the mixture, calculated as  $\text{Al}_2\text{O}_3$ .

4. Method according to one or several of Claims 1 through 3,

*characterized by the fact that* prior to the gelling, sintering additives in the form of crystallization seeds, crystal growth inhibitors and/or other modifying components that influence the sintering process are added.

5. Method according to Claim 4,

*characterized by the fact that* fine-particled  $\alpha$  aluminum oxide is used as crystallization seed.

6. Method according to one or several of Claims 1 through 5,

*characterized by the fact that the gelling of the suspensions occurs by increasing or decreasing the pH value; through aging; the addition of electrolytes; increased temperature; and/or concentrating the solution.*

7. Method according to one or several of Claims 1 through 6,

*characterized by the fact that drying of the gel is carried out in a temperature range between 50 °C and 120 °C, with subsequent calcination between 500 °C and 800 °C, and sintering in a temperature range between 1300 °C and 1600 °C.*

8. Method according to Claim 7,

*characterized by the fact that sintering is done in a temperature range between 1380 °C and 1500 °C.*

9. Method according to [Claim] 7,

*characterized by the fact that sintering is carried out under inert conditions.*

10. Method according to one or several of Claims 1 through 9,

*characterized by the fact that comminution to the desired grain size is done before or after sintering.*

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11.  $\text{Al}_2\text{O}_3/\text{SiC}$  nanocomposite abrasive grain with a hardness of  $> 16$  GPa, a density of  $> 95\%$  of the theory, and an SiC portion of between 0.1 and  $< 5$  mol %, relative to the  $\text{Al}_2\text{O}_3$  matrix,

*characterized by the fact that* the SiC particles are present in the  $\text{Al}_2\text{O}_3$  matrix as well as intragranularly and the abrasive grain shows a performance factor  $\text{LF}_{25} > 75\%$  in the single-grain scratch test.

12.  $\text{Al}_2\text{O}_3/\text{SiC}$  nanocomposite abrasive grain according to Claim 11,

*characterized by the fact that* the SiC portion preferably amounts to between 0.3 and  $< 2.5$  mol %, relative to the  $\text{Al}_2\text{O}_3$  matrix.

13.  $\text{Al}_2\text{O}_3/\text{SiC}$  nanocomposite abrasive grain according to one of Claims 11 or 12,

*characterized by the fact that* the SiC particles are predominantly present intragranularly in the  $\text{Al}_2\text{O}_3$  matrix.

14.  $\text{Al}_2\text{O}_3/\text{SiC}$  nanocomposite abrasive grain according to one or several of Claims 11 through 13,

*characterized by the fact that* the  $\text{Al}_2\text{O}_3$  crystals of the matrix show mean diameters of between  $0.2\text{ }\mu\text{m}$  and  $20\text{ }\mu\text{m}$ .

15.  $\text{Al}_2\text{O}_3/\text{SiC}$  nanocomposite abrasive grain according to one or several of Claims 11 through 13,

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*characterized by the fact that the  $\text{Al}_2\text{O}_3$  matrix has a submicron structure and a mean particle size of  $< 1 \mu\text{m}$ , preferably  $< 0.5 \mu\text{m}$ .*

16.  $\text{Al}_2\text{O}_3/\text{SiC}$  nanocomposite abrasive grain according to Claim 15,

*characterized by the fact that coarse  $\text{Al}_2\text{O}_3$  crystals are formed in the submicron  $\text{Al}_2\text{O}_3$  matrix.*

17.  $\text{Al}_2\text{O}_3/\text{SiC}$  nanocomposite abrasive grain according to Claim 16,

*characterized by the fact that the coarse  $\text{Al}_2\text{O}_3$  crystals have a mean diameter of  $> 2 \mu\text{m}$ , preferably  $> 5 \mu\text{m}$ .*

18.  $\text{Al}_2\text{O}_3/\text{SiC}$  nanocomposite abrasive grain according one of Claims 16 or 17,

*characterized by the fact that the coarse  $\text{Al}_2\text{O}_3$  crystals have an oblong shape.*

19.  $\text{Al}_2\text{O}_3/\text{SiC}$  nanocomposite abrasive grain according to one or several of Claims 16 through 18,

*characterized by the fact that the coarse  $\text{Al}_2\text{O}_3$  crystals have a length/width ratio of between 2:1 and 10:1, preferably between 4:1 and 6:1.*

20. Utilization of  $\text{Al}_2\text{O}_3/\text{SiC}$  nanocomposite abrasive grains according to one or several of Claims 11 – 19 for the production of grinding belts and grinding disks.

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